at different stages of their lives. Further experiments with much larger batches of fishes will be required in order to provide material for the construction of a complete and convincing picture of these movements. In future experiments it would be desirable to determine the sex and maturity as well as the size of the fishes liberated, in order to discover whether there is any difference in the migrations of the two sexes, and to distinguish spawning migrations from feeding migrations.

From time to time, over a period of fifteen years, but, unfortunately, not with any regularity, experimental hauls have been made by the Lancashire authorities with shrimp-net, shank-net, and fish-trawl both on the Blackpool closed ground and in the Mersey estuary. The numbers of flat fishes and shrimps caught in these hauls form the basis of two short but valuable papers by Mr. Buchanan-Wollaston. The method adopted in this research is that of reducing the catches to the average number caught per hour in different months, quarters, and years, and then expressing the results in the form of frequency curves. The curves for the monthly data were too irregular to show any general tendency, but by taking the averages for certain combinations of months and for different years, and "smoothing" the curves thus produced, certain interesting features are brought to light. Thus it is clearly seen that on the Blackpool closed ground there has been a steady falling off in the catch per hour of plaice since 1892. No explanation is offered of this remarkable phenomenon, which, one supposes, must be due to the increased intensity of fishing on the offshore grounds. It is also shown that the "shank-net" is "superior to the shrimp-trawl in avoiding the capture of young fish, and this with no loss or even a small gain in the capture of shrimps."

In the Mersey estuary, plaice and soles reach their maximum abundance in late summer and autumn, but it is doubtful whether the data are sufficiently complete to justify the conclusion that soles attain their maximum in August and plaice in September. Finally, an examination of the (smoothed) curves showing the average catch per hour of plaice and soles on the Mersey banks shows some remarkable fluctuations, those of the two species being complementary, so that in those years when plaice were least abundant, soles attained their maximum. The importance of such researches as these from the point of view of the local fisheries scarcely requires to be emphasised.

In addition to these papers, Dr. H. Bassett contributes one on hydrographic observations, and Mr. Johnstone one on fish parasites.

As regards the work of the Piel hatchery, while it is questionable whether any demonstrably useful purpose is being served by annually "dumping" in the Irish Sea millions of newly-hatched fry of plaice and flounder, it seems not improbable that the holding of classes for fishermen is as effective in practice as it is excellent in theory.

It will thus be seen that the work which these two institutions are vigorously carrying on in the interests of marine biology in general, and the local fisheries in particular, is of a comprehensive and many-sided character. The expenses of this work appear to be met by funds derived from several distinct sources. For example, the cost of holding classes for fishermen at Piel is defrayed by a grant from the education committee of the Lancashire County Council, while Mr. Pearson's work on the crab was done and published, we are told, under the auspices of the Lancashire Sea Fisheries Committee, with the aid of grants from the Board of Agriculture and Fisheries, the University of Liverpool, and the Liverpool Marine Biology Committee. This appears to be a somewhat complicated arrangement, which perhaps, however, has the advantage of the safety which is popularly supposed to reside in numbers. It shows, at any rate, that marine biology in Lancashire does not lack friends.

W. W.

LABORATORY ARTS.

Laboratory Arts. A Teacher's Handbook dealing with Materials and Tools used in the Construction, Adjustment, and Repair of Scientific Instruments. By Dr. George H. Woollatt. Pp. xii+192; with 119 diagrams. (London: Longmans, Green and Co., 1908.) Price 3*s*. 6*d*. net.

SKILL and wide knowledge in "laboratory arts" are much rarer attainments than the accumulation of ideas relating to abstract or even to mathematical physics, yet, without making comparisons, it is essential to the success of the experimentalist. If it were not for the fact that such skill and knowledge are not to be acquired by mere reading of a few books, it might be thought that the disproportion alluded to above might be the result of the still more marked disproportion between books of the text-book type dealing with the two branches of attainment. Actually, it is probably the cause, or partly so, and it may be also that the scarcity of books such as that now being noticed is due to a belief on the part of the few qualified to write them that, dealing as they do with a subject which directly is not an examination subject, there will be no great demand for them. Whatever the cause may be of the scarcity of books dealing with laboratory arts, they are actually invaluable, and from Faraday's chemical manipulation onwards they furnish the experimentalist with ideas as to how to accomplish his purpose.

Dealing as such books must do with all the properties of all materials and with the means peculiar to each whereby they may best be cut, distorted, attached, or protected, it is not possible for any one writer to be equally strong in all parts. A writer is certain to be specially strong in certain departments; let it be so; those who are or might be his fellow-writers of similar books will be quick to recognise these parts, and to benefit by them. Conversely, of course, no one book is likely to be quite satisfactory in dealing with every kind of operation where they are so diverse. Leaving now generalities and coming to the "Laboratory Arts" as presented by Mr. Woollatt, we find an admirable choice of material admirably presented. It must be understood that the teacher or the experimentalist probably is not and may not even want to be accomplished in the art of using tools and producing results in the conventional way as performed in the way of trade by the professional. In the opinion of the writer of this notice, he ought not to want, for in that case he is certain to sacrifice his interest in the object for which he is preparing something to the preparation itself; he will change from the experimentalist to the amateur mechanic. He must, if he will retain his *rôle* as experimentalist, learn to be ruthless, and, if necessary, to do brutal things and defy every convention, so long as he attains his object. The author expresses this idea more neatly as follows:—

> "The craftsman will doubtless find humour in some of the suggestions put forward herein, but it should be remembered that we are first of all teachers, and that we must use skill in craftiness in order to overcome our lack of the craftsman's skill. These are methods that will serve our purpose, and they are within our resources."

Was not the same idea expressed by the great Fresnel nearly a century ago in words such as these:—"If you cannot file with a saw or saw with a file you will be no good as an experimentalist"?

Wood-work, metal-work, and glass-work are the subjects of the first three divisions of the book, and these are supplemented by one called general, in which sixteen diverse subjects are treated, and these are followed by three appendices and an index. It would be tedious, and it would serve no useful purpose, to go through these chapters seriatim. It is sufficient to say that the descriptions are clear and are well illustrated, and that the book will be a valuable if not an invaluable addition to the working library of every physical laboratory. While commendation is justly earned by the author, there are a few points to which the writer would direct his attention in the hope that they may assist him in the preparation of the second edition.

In the section dealing with grinding and sharpening, the use of emery or carborundum wheels for grinding, or of artificial hones made of these materials for sharpening, is not suggested. The writer would urge that the natural stones have been superseded; he would be glad to know the experience of others with a slab of aluminium as a hone for the production of a fine edge. A solution of camphor in terpentine is, as is usual, recommended for use when drilling glass. The writer has always wondered what the camphor is for and if it makes any difference, for a recipe of this kind is and always will be faithfully repeated in book after book even when useless. Camphor dissolved in turpentine is used in making certain tailed stars for rockets. Did a firework-maker once lubricate a drill with the only turpentine he could find and thus start the use of camphor? Prof. Threlfall is most enlightening on the subject of drilling glass in his book on laboratory arts.

It is an omission to describe methods of cleaning mercury and ignore the existence of the vacuum still, which ought, in the writer's opinion, to be set up permanently in every physical laboratory. Similarly, it is an omission to describe a number of well-known cements and ignore the existence of that most useful addition to the resources of the experimentalist, viz. the much advertised cæmentium. The writer has used this material on all classes of substances, and he considers it one of the most useful in the laboratory. He would mention incidentally that it does not ruck up the end grain of soft wood, so that badly made patterns may be quickly smoothed over with it and interior angles filled in without producing a hedgehog back, as is the case with shellac varnish, and giving rise to the necessity for much glass-papering. Soldering is described as practised with the tinman's "bit." This, it is true, is often, especially with sheet work, exceedingly useful, but for nearly all the operations of the laboratory, especially when thicker work in brass is to be put together, the method known as sweating is preferred, and will be practised nine times while the bit is used once. The process of sweating is not described, nor is there given the very important direction to wash well and, if possible, to boil everything that has been soldered or sweated with chloride of zinc. Silver soldering is the cleanest and neatest form of brazing, and it is surprising that it is not more commonly practised. The author's description appears to the writer somewhat meagre. The essential to success being a uniform low red heat, the process is much more easily carried on in a fire bed or in a muffle than by a more fierce and local source of heat such as a blowpipe. Where this is used, every use that is possible should be made of reverberation from pieces of firebrick to maintain the heat uniform.

The author rather lets himself go when he gets to varnishing, staining, French polishing, and sand-papering. Information of the kind is very useful in its way, but if there is anything in which the student should not be encouraged it is on the "beautification" of his apparatus. Varnish or paint for preservation are well enough when there is necessity to preserve; as a rule, experimentalists' apparatus is made, used, and done with; it requires neither beautification nor preservation. The results obtained may be worth the latter.

We would, in concluding this notice, refer to two passages in the preface:—

> "The ability to 'fix up' a piece of uncatalogued apparatus, by which a point under discussion may be proved, is worth the expenditure of time and trouble in its attainment, but until now no systematic attempt has been made in this direction, and it is only through the organisation of summer courses for science teachers in Ireland and Yorkshire that the prospect of success is held out."

And again:—

> "The result must be a quickening of interest on the part of teachers able for the first time to construct their own special apparatus."

Has the author ever heard of the late Dr. Guthrie, who instituted this identical work at South Kensington, and sent out into the country hundreds of science teachers armed, it is true, with imperfect craftsmanship, but for all that able to "fix up" simple apparatus with simple means? Dr. Guthrie's successors have not neglected the study of laboratory arts either, and anyone who has been connected with South Kensington must resent the suggestion that the desideratum here set forth is now capable of attainment for the first time. C. V. Boys.

MORAL EDUCATION.

(1) *Moral Instruction and Training in Schools.* Report of an International Inquiry. 2 vols. Edited by Prof. M. E. Sadler. Vol. i., pp. lviii+538; vol. ii., pp. xxviii+378. (London: Longmans, Green and Co., 1908.) Price 5*s*. net each.

(2) *Papers on Moral Education communicated to the First International Moral Education Congress.* (London: David Nutt, 1908.) Price 5*s*.

THE recent congress on moral education and the volumes which contain the results of the international inquiry upon the subject have rendered at least one great service to current educational thought. They have given us, on the one hand, a large amount of information on what is being done in various parts of the world in the matter of moral instruction and training, and, on the other hand, a series of valuable essays upon the various aspects of the problem as it presents itself to responsible persons, by means of which it is possible to examine some of the fundamental issues which are raised.

As Prof. Sadler frankly admits in his admirable preface to the committee's report, there is much variety of opinion expressed in its pages, and we may note at once that each of these many opinions is based upon experience. They furnish another illustration of the fact that successful experience is not always a safe guide in reaching scientific conclusions. Successful experience may even darken counsel! Witness the experience of those races who succeed in driving away the evil spirits who are attempting to destroy the light of the moon during an eclipse. In important matters of practice we are naturally eager to arrive at a guiding principle, and interest centres in the successes of this or that method. In our impatience to act, we do not wait to consider the failures, and we have no time to give to the wearisome analysis which aims at laying bare the elements that condition success and failure alike. Nevertheless, it remains a fact that, until this has been done, all procedure, even successful procedure, is little more than groping in the dark.

Such general agreement as is revealed in these volumes would perhaps be represented by a rather empty formula defining the aim of moral education, shall we say? to lead the individual to accept some principle which will give unity and meaning to his life. So soon as we step outside this or some similar statement, differences of a two-fold character are revealed. In the first place, we find them in the answers to the question, What is to be the nature of this unifying principle? "Service," says Mr. Gould; "the freedom of the inner life," says Prof. Foerster; whilst Dr. Penzig refuses teleological considerations any place in moral instruction, and others, again, would find the unifying principle in the conception of the active interest and supervision of a Divine Personality; and in the next place we find them when we inquire about the method to be followed in the effort to lead pupils to this principle. Here the differences are in part consequential upon the individual attitude to the previous question. It will make a world of difference, for example, whether the definitely religious point of view is accepted or not. But, leaving that particular difficulty aside, there remains the conflict between the advocates of the direct and systematic treatment of morals and those who favour indirect and incidental teaching. Both parties to the conflict admit the fundamental importance of training, of habit formation, but the former would have, in addition, definite lessons in the "oughts" of life, drawn from the consideration of concrete illustrations of virtuous and of foolish action, as told in story by the teacher. The point of view is precisely that of the teacher who wishes to establish a scientific law. The pupil is led to derive the law from the comparison of carefully chosen concrete examples. At a later stage various generalisations may be reviewed and compared with the view of arriving at a still more general principle, until finally the most widely embracing uniformities are conceived and formulated as "laws of nature."

This attitude towards the problem appears to rest on two assumptions. It seems to place moral law and physical law in the same category, and it seems to take for granted the child's capacity to analyse conduct and motive in the objective manner of some adults. It is not necessary to insist at length upon the difference between an ethical principle and a scientific generalisation. The ethical principle is a matter of personal adoption; it has a psychology and a meaning which differ fundamentally from the intellectual apprehension of a uniformity in the phenomenal world. There can be no analogy between the two such as would justify the statement that "the relation between indirect and direct moral instruction is the same as that between nature-study and science." The point is touched, though somewhat slightly, by M. Gabriel Séailles in a thoughtful paper read to the conference. Incidentally he also puts his finger upon the errors in psychology which not infrequently underlie the advocacy of the systematic treatment of the subject.

It is said, for example, that the children of poor districts are face to face with problems of gambling, intemperance, &c., and the school should come to their rescue by teaching them the wickedness of all these things that make up the daily life of their parents. As to the problems in the midst of which such children are said to find themselves, are the facts of their environment in any sense problems for the children? The lad who plays pitch and toss finds his problem in the effort to escape the vigilance of the policeman. A problem implies a contradiction felt in the actual experience of the individual. A contradiction between what the teacher says and the dominating facts of an out-of-school life will cause no more difficulty than the mathematical treatment of a space of four dimensions will affect my attitude to the facts